

*“It feels like we’re doing something good.”
Mapping farmer perceptions of Zero
Budget Natural Farming onto crop yields
in Andhra Pradesh*

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Research paper

“It feels like we’re doing something good.” Mapping farmer perceptions of zero budget natural farming onto crop yields in Andhra Pradesh

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ABSTRACT

India is a leader in the transition to natural farming, and the state of Andhra Pradesh is at the forefront. This interdisciplinary study seeks to understand the motivations behind Zero Budget Natural Farming (ZBNF) adoption in two districts in different climatic zones in Andhra Pradesh (Anantapur and Visakhapatnam). Public messaging about ZBNF generally relies on success stories based on increases in yield and income, with a reduction on expenditures. We use participatory photography to understand subjective farmer stories about natural farming and map these responses onto field experiments measuring crop yield to reveal a more complex range of drivers behind adoption. By studying the contents and effects of subjective farmer stories and comparing the yields of natural farming plots with organic and conventional plots, we show that natural farming yields support public messaging in some contexts where the transition is taking place, but less so in others. While the mainstream messaging about the benefits of natural farming is certainly a motivating factor for adoption, there are also many *unquantifiable* subjective gains perceived by farmers inclusive of memory, legacy, independence, and a rejection of industrialized agriculture, which also drive adoption. Understanding these unquantifiable subjective gains, and how they connect to ZBNF innovations in the fields, can improve two-way rural communication about natural farming and drive future context-specific research.

1. Introduction

Natural farming is gaining prominence and popularity, particularly in India, because it is seen as an environmentally regenerative way of growing food, founded in an equitable relationship between farmer and nature, that addresses a wide range of social and ecological challenges (Varaprasad & Visweswara Rao, 2024; Bana et al., 2022; Bharucha et al., 2020). Understanding what the drivers of natural farming adoption are can support its widescale expansion. Taking an interdisciplinary research approach facilitates a holistic and deeper examination. This study maps participatory photography responses onto field experiments measuring crop yield to understand the drivers of natural farming adoption in two districts in Andhra Pradesh, India—Anantapur, a low rainfall zone, and Visakhapatnam, a wet zone which receives double the

rainfall of Anantapur. By studying the content and effects of stories told through participatory photography, we use a narrative analysis to understand the underlying subjective perceptions of Zero Budget Natural Farming (ZBNF) by women members of self-help groups (SHGs). When mapped onto our soil science experiment findings, we show that the adoption of natural farming involves multi-layered decisions that are based on more than just material considerations, such as yield and income, but are also sensitive to memory, legacy, independence, and clean living.¹

ZBNF is an agricultural practice that emphasizes the use of defined ‘chemical-free’ inputs (no synthetic fertilisers or pesticides) and regenerative farming techniques as an integrated approach toward socio-ecological resilience (Duddigan et al., 2023). ZBNF inputs are made at home by members of a household or their farming community. In

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¹ To read more about the soil science dimension of this study see Duddigan et al., 2022. To read a detailed paper discussing the novel methodology designed for this study see Walker et al., 2021.

Table 1
Locations and crops grown in field experiments.

District	Farm	Latitude (°)	Longitude (°)	Season 1 (Kharif) Crop**	Season 2 (Rabi) Crop***
Anantapur	1	14.251	77.012	Groundnut	Chilli
	2	13.901	78.009	Groundnut	Aubergine
	3	14.457	77.217	Groundnut	Tomato
Visakhapatnam	4	18.039	82.686	Radish	No experiment*
	5	18.001	83.375	Okra	No experiment*
	6	18.000	83.379	No experiment*	Carrot
	7	17.952	82.876	No experiment*	Groundnut

* No experiment run – farm did not participate in this season.

** Season 1 yield data published in [Duddigan et al. \(2022\)](#).

*** Season 2 yield data published in [Duddigan et al. \(2023\)](#).

addition to a defined input balance, ZBNF also relies on other agricultural principles, ranging from what is widely considered good practice (mulching) to mystical (mixing a concoction by stirring it only in a clockwise motion). Its origins are traced back to Subhash Palekar, who first pioneered this heterodox farming method involving natural inputs centred on the *Desi* cow. Equally, ZBNF is predicated upon an outright rejection of many of the principles of conventional farming.

In Andhra Pradesh, ZBNF was institutionalized by the state government through the establishment of Ryuthu Sadhikara Samstha (RySS), a not-for-profit organization intended to function as a ZBNF extension agency. As a research partner, RySS were able to facilitate access to communities experimenting with this practice. In 2020, ZBNF practice within Andhra Pradesh was rebranded by RySS as APCNF (Andhra Pradesh Community-Managed Natural Farming). This shift moved away from Palekar's four wheels of ZBNF and instead emphasized nine overarching principles of natural farming.² The practice is clearly evolving with the introduction of new innovations and organizational shifts as it aims to scale out to more than six million farmers in the state ([RySS, 2024](#)). Despite this, and the fact that our study was situated exclusively in Andhra Pradesh, we chose to retain the use of the term ZBNF to connect our findings to broader arguments informing the wide-scale adoption of natural farming. Further, all the field experiments discussed in this paper were initiated before the rebrand. Regular reviews of the social science and soil science dimensions of this study helped to understand how different datasets could reveal greater insights when viewed together than they could in isolation. This paper uses the combined insights from two districts in Andhra Pradesh, India, to reveal the drivers of natural farming adoption.

2. Background of the study

Zero Budget Natural Farming is framed as a solution to land and soil degradation resulting from years of application of synthetic chemicals on agricultural lands. In Andhra Pradesh specifically, intensive chemical farming is also associated with negative societal repercussions such as an increase in farmer debt—when money is borrowed to purchase costly inputs—and the subsequent tragic phenomenon of farmer suicides, where farmers, unable to pay back their loans, make the decision to end their lives ([Merriott, 2016](#)).

The influence of Hindu culture is manifest throughout ZBNF, which could suggest a political dimension—an implication not necessarily warranted—because of associations with revanchist Hindu nationalist movements in India today ([Münster, 2018](#)). Scholars have highlighted

² The nine universal principles of natural farming as determined by RySS are: soil to be covered with crops for 365 days (living root); minimal disturbance of soil; biostimulants as necessary catalysts; the use of indigenous seed; diverse crops and trees (15–20 crops); integrate animals in to farming; increase organic residues on the soil; pest management through botanical extracts; no synthetic fertilizers, pesticides, or herbicides ([RySS, 2024](#)).

the dangers of appropriation of environmental and agricultural movements by neo-traditionalist Hindu nationalism ([Mawdsley, 2006](#)). Other critiques of APCNF specifically ([Ramdas & Pimbert, 2024](#)) point to a lack of progress in subverting existing unequal power relations within agricultural production, such as those defined by caste, land ownership, and capitalist capture; however, the purpose of this paper is not to weigh in on these current wider debates surrounding APCNF and ZBNF broadly. Nevertheless, it is important to acknowledge, at the outset, the complex political economy in which the practice is embedded.

Scientifically, the ZBNF movement is also not without critics, often stemming from the fact the practice is perceived to be driven by ideology as opposed to scientific evidence ([Kumar et al., 2019](#)). Similarly, in an earlier paper, we conclude that “There is a genuine danger that the success of the social movement fuelling the adoption of ZBNF practices has become out of step with science that supports its efficacy” ([Duddigan et al., 2022](#), p. 3). We determined that on-the-ground evidence was lacking to support many of the public claims made by ZBNF advocates. The soil science study, which will be described in greater detail, established experiment plots that aimed to demonstrate the yield output of ZBNF agriculture compared with conventional (chemical) and organic amendment farming. Because we are approaching the practice through an interdisciplinary lens, the social science study took a theoretical position grounded by a Freirean understanding of knowledge in context. Freire writes:

The concrete reality for many social scientists is a list of particular facts that they would like to capture; for example, the presence or absence of water, problems concerning erosion in the area. For me, the concrete reality is something more than isolated facts. In my view ... the concrete reality consists not only of concrete facts and physical things, but also includes the ways in which the people involved with these facts perceive them. ([Freire, 1982](#), p. 29)

Were yields genuinely increasing and were farmer perceptions of natural farming in step with the objective reality observed in the fields? Likewise, did positive perceptions of ZBNF's unquantifiable socio-cultural gains have the power to drive the adoption of natural farming? These questions can only be answered through an interdisciplinary research study that investigates both the land and the perceptions of the people living on top of it. Therefore, by understanding the ZBNF system as a whole—not just the biophysical processes playing out in the soil but also the societal structures in which natural farming is embedded—our research aims to develop a richer portrait of a complex system.

By understanding the narratives that frame the underlying perceptions and drivers of adoption and innovation, ZBNF proponents may be able to deliver clearer, targeted messaging that does not ignore the official pronouncements still undergoing scientific scrutiny but, rather,

weaves them into stories that resonate with farmers' *inner library*³ of stories. The argument in favour of ZBNF therefore does not rely only on straightforward economic logic, which is invariably reductive and unappreciative of nuance and context. On a wider level, if a transition away from conventional farming, which has clear benefits for soil health, sustainability, and the mitigation of debt accumulation on the part of farmers, resonates for reasons beyond the balance sheet, then integrating these reasons into extension messaging can add volume to the one-dimensional notions of yield-based "success" and "failure" delivered through rural advisory services. As part of a sub-national or national level program of NBS, the inclusion of subjective farmer adoption narratives can reframe NBS around justice and empowerment, answering calls for NBS to achieve more than it could as an apolitical agenda (Cousins, 2021).

3. Soil science methodology

Current anecdotal evidence on the efficacy of ZBNF practices reported in the literature, compared to 'non-ZBNF' systems, needs to be supported by controlled replicated field trials (Smith et al., 2020). Therefore, controlled field experiments that directly compared ZBNF to conventional and organic alternatives were established in three farms in Anantapur and four farms in Visakhapatnam (Table 1). Full details of the experimental design can be found in Duddigan et al. (2022). Briefly, experiments consisted of three treatments (ZBNF, organic, conventional) applied to 6 x 6 m plots, replicated three times in a Latin square design (3 treatments x 3 replicates = 9 plots). The same number of seeds was sown on each plot and crops were grown as a monocrop.

Crops selected were Aubergine (*Solanum melongina*), Chilli (*Capsicum annum* L.), Carrot (*Daucus carota*), Groundnut (*Arachis hypogaea*), Okra (*Abelmoschus esulentus*), Radish (*Raphanus sativus*) and Tomato (*Solanum lycopersicum*). Crop selection for each experiment was based on suitability for the district and local trends (e.g., what neighboring farms were growing) to be representative of local practice. It was important that crop selection was in keeping with local practice, as experiments also served as demonstration farms to the local community, and they wanted to see the crops they were growing. Experiments were conducted across two seasons: the warm, wet monsoon or *kharif* season (June–November), and the cooler drier *rabi* season (December–May). Mass of produce harvested from each plot, as it would be taken to market (e.g. dried groundnut kernels, or fresh biomass of vegetables as they were picked), was weighed and recorded as the yield.

Yield variability between farms and crop varieties makes it difficult to examine differences between treatments across all the farms. Therefore, a *z* transformation was used to put the yield of each of the nine plots into the context of the average farm yield. The transformed yield (*z*) was calculated by subtracting the average yield of all nine plots in an experiment, from the yield of a single plot, and dividing by the standard deviation of all nine plots. Therefore, if a plot *z* is below 0, then the plot yield is below the farm average, and if *z* is above 0, the plot yield is above the farm average.

A mixed effects model (using restricted maximum likelihood, or REML, estimations) was conducted on *z* transformed yield data, using Minitab Version 21. The model allows us to assess whether there was a significant difference between the farming treatment (conventional, organic, or ZBNF) in addition to whether the difference in treatment is dependent on the district (Anantapur or Visakhapatnam), the season (*kharif* or *rabi*), or the crop selected (i.e., whether ZBNF efficacy is context specific).

³ According to Frank (2010), the inner library contains the stories from a person's own context, culture, or narrative habitus (drawing on Bourdieu). These are the insider stories one responds to, as opposed to outsider stories that may not have any power to effect change upon or even resonate with the listener.

4. Participatory photography methodology

Participatory photography has been gaining popularity (Bandauko & Arku, 2023), including among smallholder farming communities (Hazenbosch et al., 2022), and was chosen as a method of data collection because of the scope visual methods provide for subjective interpretation. The specifics of the process we developed were based both on longstanding traditions of Freirean investigation through participatory action research (PAR), and on established participatory photography practices, such as *Photovoice* (Wang & Burris, 1997).⁴

Our methodological approach also leans upon theories that account for a 'hidden transcript' used by dominated groups as a countervailing mechanism against hegemony (Scott, 1990). Using a hidden transcript as our conceptual anchor point, we sought to understand the compelling factors for adoption and innovation that are not already apparent on the 'public transcript' of ZBNF, which include the aforementioned factors such as increased yield and lower expenditures on farming inputs, in addition to other public transcript drivers of adoption such as more nutritious food and higher incomes.

We therefore categorized individual photo story responses as 'on-script' or 'off-script' (Walker et al., 2021). These categorizations were based on the extent to which responses mirrored the public transcript of ZBNF or diverged to subjective farmer perceptions conveyed through stories about their own individual lives that they presented to their peers as outcomes of ZBNF adoption. 'On-script' motivations capture the reasons a farmer may adopt ZBNF that reflect the official pronouncements and messaging about the methods, beginning with Palekar down to the local-level natural farming fellows (NFFs) stationed in Andhra Pradesh villages as ZBNF extension agents on assignment from RySS. 'Off-script' motivations, meanwhile, include the underlying perceptions a farmer may have, which influence their choice to adopt ZBNF. These include root causes based not on quantifiable outcomes, but on qualitative drivers such as independence, consciousness, memory, and legacy, with multiple sub-narrative types scaffolding each of these.

Our overarching aim was to initiate a process of storytelling about ZBNF that would avoid finalization and allow participants to go 'off-script' in their response to themes (Walker et al., 2021). The activity itself drew on Freirean traditions in that it used problem-posing and generative themes to penetrate beneath surface meanings, clichés, and received wisdom, to reveal subjective meaning within a social context (Shor, 1992). One of the core positions of PAR is that subjectivity is not readily accessible to groups who have been historically marginalized, such as rural smallholder farmers. These groups have internalized external descriptions of themselves to the extent that they have taken ownership of those descriptions and will even defend those descriptions as if they were their own (Rahman, 1991; see also Lenette, 2022). Echoing this, Frank writes: "Experience is understood as residing as much outside persons as inside them; it is borrowed as it is felt" (2010, p.119). The PAR process enables a group to tell stories, and in turn, borrow from those stories to form the basis of another investigation. That process enabled project participants to slowly articulate alternatives to the 'on-script' messaging they had been accustomed to repeating when discussing natural farming.

The first phase of the participatory photography activity was capacity-building. We trained one NFF in each of the two districts as participatory photography facilitators, and each of those NFFs worked with two women's self-help groups (SHGs) in her respective village. The

⁴ We published a paper focusing specifically on the novel participatory photography methodology developed for this study (Walker et al., 2021). Our description here is therefore not as detailed or extensive, which allows us to focus more on results and how they map onto soil science findings, rather than methodological considerations. However, we do point readers to our aforementioned paper if they are interested in reading an in-depth theoretical and practical summary of our methodological approach.

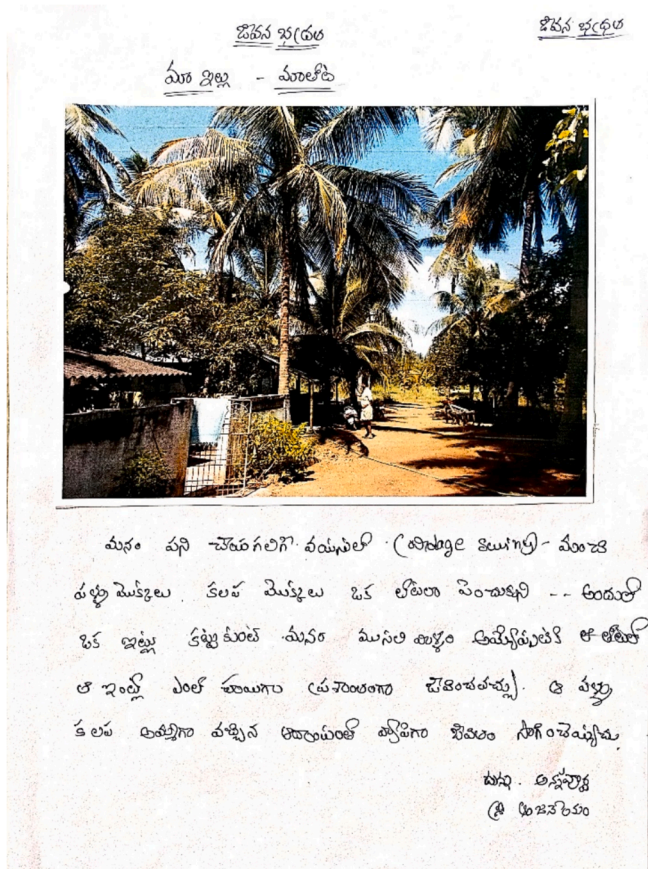


Fig. 1. This image from Visakhapatnam is a representation of the theme *Secured Life*. The image is titled *Our Home – Our Garden*. The accompanying text reads: “During our youth we must grow fruit trees and timber like a garden, and build a house in the garden, then by the time we get old we can relax peacefully in that garden and in that home. I will live my life happily with the income generated from the fruits and timber.”

SHGs were originally launched as microcredit groups, and their membership was seen as an ideal launching point for the dissemination of ZBNF messaging.⁵ The NFFs were provided with two simple digital point-and-shoot cameras, one to share with each SHG. They were residents of the village and were acquainted with the SHGs, which usually numbered between eight and ten members. The SHGs comprised a mix of women farmers, both landowners and tenants, with varying degrees of influence within the group, which included some who had fully adopted ZBNF practices, others using partial ZBNF practices, and non-ZBNF farmers. Across the two districts we focus on in this paper, four SHGs (two in Anantapur and two in Visakhapatnam) produced 141 images with written responses (subsequently translated into English from Telugu). These written descriptions often took the form of short stories that were used to contextualize an image. See Fig. 1 for an example of a photo response to a theme and the way it is framed by the participant as a short subjective ‘story’ rather than a simple description of what is shown in the photograph.⁶

⁵ See Tesoriero, 2005, for more detail on SHGs.

⁶ Participants wrote their first names on the image responses. All the partial identities presented in the paper are done so in accordance with the informed consent received from each participant (first name and last initial only). This is a balance we struck with participants who wanted to be credited for their creative work. Our PAR research outcomes were treated as the intellectual property of the participants for which we, the research team, were given permission to use through informed consent.

At the beginning of the activity, the NFF provided the SHG members with a *topical theme*—an issue worthy of consideration that is presented by the facilitator (Shor, 1992)—to serve as the subject matter of their first photo. In all the SHGs, the topical theme was either ‘ZBNF Innovations’ or a specific ‘on-script’ innovation from ZBNF practice such as “Mulching” or “Cow-based Farming”. This anchored the activity to ZBNF, and the group analysis of the images photographed to represent that theme led to the first *generative theme* (Freire, 1970). The process was repeated, and another generative theme was selected, with thematic discussions moving farther ‘off-script’ in each instance, as photos began to reflect stories about culture, tradition, memory, legacy, and other fragments of the hidden transcript.

Unique to our participatory photography praxis was the use of thematic collages (Walker et al., 2021). A thematic collage invokes Becker’s notion of photo images as “specified generalizations” (Becker, 2002, p. 11). Subjectively, to the photographer, what the image represents is a real person, or a real place—something specific. To others, they represent a “general story of which they are instances” (p. 11). For example, an image taken by a participant of the photographer’s brother, recently returned from the city, who is using a newly purchased tool in the field, becomes generalized to a “person working in the field” when seen by others. The back story is hidden, but associations can still be made because they recognize the man’s clothes and the landscape, identifying him as “one of their own”. When a series of images representing a certain theme (“ZBNF Innovations”, for instance), are placed side by side in a thematic collage, each individual photographer’s specified image is juxtaposed with eight or nine other images. The specificity of the single image is surrendered to the generalization of the theme created by the effect of the collage. An individual’s story becomes part of the group’s story. Specificity is lost but common ground is gained as interpretation becomes a group activity, and group subjectivity is represented in the discussion, during which differences and similarities between the images are called out.

The participatory photography responses themselves, which included some incredibly poignant stories and visually striking images, are effectively drivers in a process of investigating one’s context through the analysis of stories, rather than pieces of “data” to be analyzed in isolation. Wang and Burris (1997) write, “No claim is made that the data that emerge from the process [of participatory photography] are representative in a social scientific way. But taken together, there may be enough internal and external replication to suggest that the findings provide a reliable picture of people’s priorities at a particular historical moment” (p. 382).

The decision to establish participatory photography groups in different districts in Andhra Pradesh mirrored the design of the soil science study, which sought to compare ZBNF with other types of agriculture in different agroecological zones in the state that have varying types of soil, water availability, and other biophysical characteristics. Likewise, we understood that there may be diverse ‘off-script’ reasons for adoption across different agroecological zones, even though ‘on-script’ motivations for adoption across the regions remained the same (for example, increased yield or more income). While official pronouncements are geographically framed to a degree—relating to water retention in dry areas, or disaster resilience in coastal districts vulnerable to cyclones, for example—they are still connected to the same fundamental assumptions regarding agricultural adoption and innovation. Of added interest to us was whether the social reality was different across the districts in which we established PAR studies. We anticipated that this might be reflected in the stories that participants told through their photograph responses.

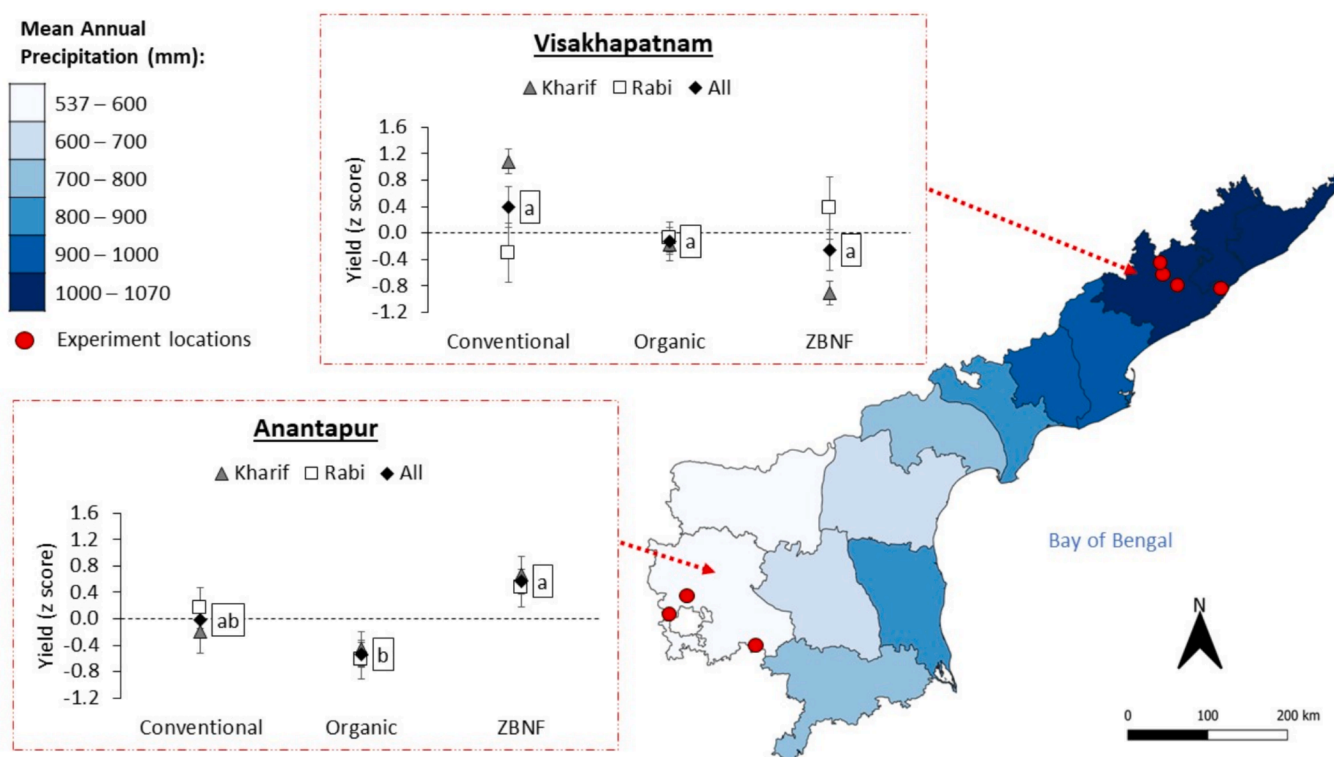


Fig. 2. Yield (z transformed) across two seasons (kharif and rabi) in Anantapur and Visakhapatnam, Andhra Pradesh. The mean of each treatment (conventional, organic, ZBNF) across all experiments in that district in *kharif*, *rabi*, and a mean of both seasons ('All'). Error bars are standard error of the mean. Treatments labelled with the same lower-case letter (a, b) in a particular district are not significantly different according to the REML mixed-effect model.

5. Soil science discussion

5.1. Profiles of the study sites

5.1.1. Anantapur district

Anantapur is in Andhra Pradesh's southern scarce rainfall zone with average annual rainfall in the district of around 500–600 mm, and temperature 28–29 °C. It is categorized as a "poor" district (with income less than USD 1.25 per day, per capita), and is located far away from urban centres (Reddy et al., 2014). While agriculture remains the most important economic activity in the district, there are elevated levels of drought vulnerability (Rukmani & Manjula, 2010). This vulnerability to drought creates feelings of general uncertainty among farmers which has had tragic consequences. The Government of India declared Anantapur one of India's districts most prone to farmer suicides and has established committees to specifically investigate the agricultural and social crises in the state (Rukmani & Manjula, 2010).

5.1.2. Visakhapatnam district

Visakhapatnam District, in the north coastal zone, is home to Andhra Pradesh's largest city, which is also called Visakhapatnam.⁷ The district is considered high in agricultural production and is classified as "rich" (with income above USD 2.18 per day, per capita)—the only district in the state with that classification (Reddy et al., 2014). While the district's coastal location makes it vulnerable to cyclones in the Bay of Bengal, its lowland villages enjoy comparatively better access to water, infrastructure, and markets. Average annual rainfall in Visakhapatnam is double that of Anantapur (1000–1100 mm), and 2 degrees cooler (26–27 °C).

5.2. Yield comparisons in Anantapur and Visakhapatnam

Performance of ZBNF was context specific and dependent on the district (Fig. 2). Experiments conducted in the scarce rainfall zone district of Anantapur observed a higher yield in the ZBNF treatment than the conventional and organic treatments. This is in concordance with several other studies that observed higher yields in ZBNF compared to 'non-ZBNF' agricultural practices (Bharucha et al., 2020; Galab et al., 2019). However, these studies do not define what they mean by 'non-ZBNF' (i.e. organic, conventional, or both). The higher yield in ZBNF in our study, however, was only enough to be significantly higher (statistically) than the organic treatment. Performance of ZBNF was consistent across the two seasons in Anantapur. In the wet district of Visakhapatnam there was no statistically significant difference between ZBNF, conventional, and organic treatments.

We suggested in Duddigan et al. (2022) that improved soil water holding capacity could be an important yield-promoting mechanism contributing to improved performance of ZBNF. This would account for the greater yield advantage of ZBNF practices in Anantapur than Visakhapatnam. This is further evidenced by the fact that ZBNF performance was lowest in the wettest season of the wettest district (*kharif* in Visakhapatnam), although this was not statistically significant. In addition, it is important to note that in Visakhapatnam, different farms participated in each season, unlike in Anantapur, where the same three farms participated for both seasons (Table 1). Therefore, it is uncertain whether the differences between seasons were, in fact, a result of different farms participating, rather than seasonal variability.

6. Social science discussion

6.1. Analytical approach

While there are multiple ways to conduct a narrative analysis, this

⁷ Following the separation of Andhra Pradesh and Telangana, Hyderabad fell within the boundaries of the latter newly formed state.

study relies largely on the framework developed by Frank (2010), with the support of other approaches from the field of narrative inquiry, such as the comparative ethnographic narrative analysis method (CENAM, see Saint Arnault & Sinko, 2021), and narrative analysis to reveal and understand root causes in the context of agricultural communities (Walker, 2018). Frank writes that “Dialogical narrative analysis studies the mirroring between what is told in the story—the story’s content—and what happens as a result of telling that story—its effects” (2010, p. 72). Following a Freirean approach, participants captured photo stories of agreed-upon themes, beginning with *ZBNF innovations*, and the effect of those photo stories was the generation of subsequent themes for investigation, which captured participant perception at a particular moment in time. The understanding of people’s priorities at a particular historical moment is framed in dialogical narrative analysis by the principle of *perpetual generation*. According to Frank (2005), the “principle of *perpetual generation* means that narrative analysis can never claim any last word about what a story means or represents. Instead, narrative analysis, like the story itself, can only look toward an open future” (p. 967).

Narratives can be conceived of as the outer shell in which the stories told by each photo response, or series of photo responses, are embedded. Because the story responses were living ideas, not finalized, but continually expanded upon and amended through the addition of each new generative theme, participants were in constant dialogue with them. This dialogue resulted in further investigation, revealing more stories. Critics of this form of inquiry, commenting from a positivist perspective, struggle with the open-endedness of the research, in which there is no “hypothesis” to be proven. The response of narrative analysts is to claim, “narrative analysis does not aspire to the goal of inference and generalizability and seeks a different ‘way of knowing’ that is opposed to the positivistic spirit of the natural science model” (Landman, 2012, p. 33).

Following the conclusion of the activity at the research settings, the Telugu language photo descriptions were translated, reviewed, and analyzed by different project stakeholders, among them the NFFs, RySS partners from differing disciplinary backgrounds including natural scientists, and us—the academic researchers from the social science team (the “analysts”). When our analyses resulted in meaning-making and conclusions that were broadly aligned and repeated, our findings were triangulated, given that we are analysts with differing backgrounds and lenses of inquiry (Stake, 1995). Stake writes, “Since no two investigators ever interpret things entirely the same, whenever multiple investigators compare their data, there is some theory triangulation... To the extent they describe the phenomenon in similar detail, the description is triangulated” (1995, p. 113). Furthermore, examining stories from two different research sites, both of which began their activity with the same topical theme, also supports triangulation. In the next section we will show that ‘off-script’ stories often did reflect the historical reality of the district from which they emerged. Further, when mapped against yield measurements from our crop experiments in that district, the stories demonstrate that adoption decisions are tethered to historical reality, which is recorded on the *hidden transcript*, as opposed to mainstream messaging from the *public transcript*.

6.2. A comparative narrative analysis of photo responses

The soil science experiment findings provided the analysts with interesting questions. The analysis of participant stories centered on the development of a narrative typology. As mentioned, the narrative is the outer shell in which a story is embedded. Analysis began by identifying the narrative *type* to which a particular story belonged. There were no defined parameters for stories. They could be told by a single image (alone or in the context of others), a series of images, or an individual participant’s set of responses, for example. Some stories fit into multiple narrative types. The narrative types were not pre-determined; each analyst determined them according to their own subjective response to the

Table 2
Narrative typology.

Narrative typology	
Narrative types	<p>Consciousness Having deliberate knowledge, awareness, or sensitivity to something. Includes stories about:</p> <ul style="list-style-type: none"> • Health • Clean living • Good habits • Helping others • Responsibility • Being one with nature • Wisdom <p>Independence Free from external control; not depending on others for livelihood or subsistence; capable of thinking or acting for oneself. Includes stories about:</p> <ul style="list-style-type: none"> • Security (not just financial) • Empowerment • Self-reliance • The importance of money • Precarity (freedom from) <p>Memory Something remembered from the past, or that stimulates nostalgic feelings. Includes stories about:</p> <ul style="list-style-type: none"> • Happiness • Socio-historical themes • Tradition • Love for nature (as lost nature) <p>Legacy Something being handed down to future generations. Includes stories about:</p> <ul style="list-style-type: none"> • Children • Belongingness • Love for nature (as conservation and preservation) • Aspiration • Security (in the future) • The preservation of culture • Shaping the future

story. Frank (2010) emphasizes that the purpose of developing a typology is not to put stories into boxes: “Matrices look authoritative, but they risk imposing closure on what can be heard in people’s stories, because the number of boxes is limited” (p. 120). The typology had to emerge from the stories. When a typology for both districts was created, the analysis could begin to compare the research sites to determine which root causes for ZBNF innovation were location-specific, and which were shared by participants in both the wet and dry zones.

The narrative analysis for Anantapur and Visakhapatnam involved reviewing the data set of photo responses, composed of 141 individual photo stories, each a representation of a single topical or generative theme.⁸ Analysts were primed with the CENAM method for analyzing narrative data: “find and affirm what is shared, note what is similar but is [geographically] nuanced, and affirm when concepts are genuinely different” (Saint Arnault & Sinko, 2021).

Overall, our narrative typology is composed of four narrative types that emerged from the 141 individual photo stories (shown in Table 2). Each of these narrative types is an umbrella under which several sub-narratives are found. At times, a sub-narrative could fit under more than one narrative type, and often, the actual story being told through the photo response by the participant integrated more than one narrative type, and sometimes all four. To be clear, the stories themselves are

⁸ See Appendix A for a table summarizing the individual themes and their progression through the praxis.

వల్లం వైక బిక్షాం మురిసి పాలం



మా కి బోయి ఎకరాల పాలు తీయి ఇలా వల్లం వచ్చింది
 లోనగా పొలం అవుతుంది బాటలై వొట్టి బండి పానీ నలుగుడు
 కులియి మా పాలలై వట్టి కులియి ప్రకృతి వివారం పూలై
 ప్రేమ

Fig. 3. A participant response from Anantapur entitled *Land turned barren due to no rainfall*.

not representations of each of these narrative types; the types help the analyst understand what the stories are doing for those who tell them and for those who listen to them (Frank, 2010). Likewise, the participant-generated themes we discussed in the participatory photography section above are not narrative types. The themes can be conceived of as simply the starting points for the storyteller. When these themes are subjective and decided upon following consultation by insiders of a group, the stories told are ‘off-script’ and represent participant perceptions. It is important to remember that because the narrative types were determined by the analysts, our lens and subjectivity as researchers cannot be separated from the analysis. A different set of eyes might see different narratives emerge.

6.2.1. Anantapur district

Responses from Anantapur, the dry, low rainfall district, were often complicated with the use of *Trouble*. According to Frank (2010), a story becomes recognizable as a story when it is complicated with *Trouble*. Frank uses the capital T when referencing this type of narrative trouble; it is more than simply a complicating plot event, which is trouble with a small t. He writes that the narrative analyst’s “interest in *Trouble* is twofold: first, how do stories present models of dealing with different kinds of trouble, and second, how do stories themselves make *Trouble*” for those who tell them, and for those who hear them (p. 28)? Stories from Anantapur often reflected the trouble encountered by farmers living in a dry zone prone to droughts and water shortages, but the participants also integrated *Trouble* (capital T) into their stories, by representing themes in a way that problematized them. For example, representing the theme *Peace of mind*, a participant in Anantapur told a story about what prevents her from having peace of mind (see Fig. 3).

In her descriptions, she writes: “We have 2 acres of land. It has not rained yet. We also have a bore well, but the groundwater is empty so there is no water in the well. Our home is on the farm itself. We live there.” This response used the Independence narrative. The story speaks to a desire for freedom from precarity, hopelessness, and peace of mind denied by a lack of rainfall. Similarly, in Anantapur, a participant responding to the generative theme *Importance of money*, captured the following image

నా పాల దగ్గర పడిపోయిన చెట్టు

Ramalingamma
 An. Importance of money



మా గ్రామంలో వర్షం ఎక్కువ కాలం కలిగి ఉండటం వల్ల
 చెట్ల పతనం జరుగుతోంది. వాటి నుండి మనకు
 వేరైనది ఉంది. ఈ చెట్లను మనం మన
 కుటుంబం కోసం ఉపయోగించాలి.

Fig. 4. A participant response from Anantapur entitled *A tree that fell in my field*.

వల్లం వల్లం

Madhuvani
 GT - Happiness



మా గ్రామంలో సుందరమైన సమయం
 వచ్చింది. చాలా బాగుంది. ఇది చాలా బాగుంది.
 కచ్చం వల్ల ప్రకృతి అందం ఉంది. ఇది చాలా బాగుంది.
 మాకు మనస్సు సంతోషం ఉంది.

Fig. 5. A participant response from Anantapur entitled *Nature’s beauty*.

(see Fig. 4) and wrote: “Many coconut trees fell because they dried up due to a lack of rainfall in our village. They fell because of heavy winds. We will use the wood from the fallen for cooking purposes.”

In this response (Fig. 4), *Trouble* was again used by the participant. She conveyed the precarity farmers in the region face because of a lack of rainfall, but by using this story to represent the theme *Importance of money*, she also highlighted the opportunism farmers must rely upon to make the best of difficult circumstances. She will use the wood from the fallen tree for cooking fuel. This had meaning for the other participants



Fig. 6. A participant response from Anantapur entitled *Borehole in my field*. The description reads: *The water from the borehole in my field has dried up. But now, due to heavy rains, we are getting water in the borehole. We are using this water to irrigate our field. We feel joy when we receive water from our borehole.*

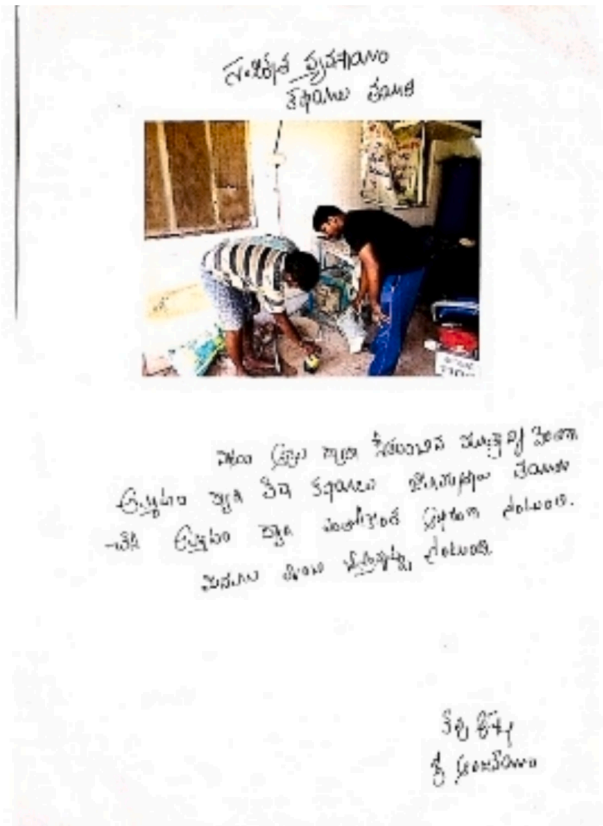


Fig. 8. A participant response from Visakhapatnam entitled *Preparation of concoctions*. The description reads: *“I am able to generate income by collecting and selling the desi cow urine and using it to prepare botanical concoctions. It feels like we’re doing something good.”*



Fig. 7. A participant response from Anantapur entitled *Dried well*. The description reads: *“This well is near to my village. Due to lack of rains, it became dry. If it had rained, this well would fill with water, and it would be used for my field. So, this well is useless right now.”*

in the SHG because of their shared concept of Trouble, which is drawn from the *inner library* of Anantapur farmers.

The importance of rain was a recurring feature of stories told by Anantapur farmers, and rain featured in multiple narrative types. Fig. 5 shows an example of the Memory narrative. The description reads: *“In the evenings in my village the environment is very nice. There is a chance of getting rain if it is like this [as depicted in the photo]. This makes us feel very joyful.”* The participant here recalls what the pre-rain environment is like and expresses the joy she derives from anticipating rainfall. She has named the photo *Nature’s beauty*. Figs. 6 and 7 provide further examples of photo responses from Anantapur that convey the importance of rain in a dry zone.

The image in Fig. 6 entitled *Borehole in my field* fits within the Independence narrative, as does the image in in Fig. 7 entitled *Dried well*. Both stories speak to the reliance on rain denying people their independence, because they have no control over the rainfall, which is scarce. Boreholes and wells provide a solution, but they are often dry or dysfunctional. The lack of water availability in this district is one of the explicit problems ZBNF is attempting to address through the introduction of natural farming principles with specific water-preserving innovations.

6.2.2. Visakhapatnam district

In the north of Andhra Pradesh in Visakhapatnam district, the photo responses tell a different story altogether. The district enjoys sufficient rainfall for farming and as mentioned, is classified as “rich” (Reddy et al., 2014). While the Independence narrative was also utilized frequently in Visakhapatnam, its stories were told without the need to activate Trouble. Independence was not a longing to have freedom from precarity, nor was it something that was sought after yet unattainable, as



Fig. 9. A participant response from Visakhapatnam entitled *Energy*.

it was for farmers in Anantapur. Independence was something the farmers already possessed and spoke about with pride, which we will show through examples. In addition to the Independence narrative type, farmers in the north also leaned heavily on Consciousness, Memory, and Legacy in their stories.

The image in Fig. 8 is an example of the Independence narrative, which shows independence through income generation. While ‘integrated farming’ was a generative theme in Visakhapatnam, and still reflected many on-script responses about natural farming, the description adds that “it feels like we’re doing something good.” This is an example of the Consciousness narrative type which dominates the responses in the district: the idea that natural farming “feels good”, that it evokes a feeling among the farmers that they are doing the right thing. This belief can help account for natural farming adoption even though yields may go down and labour inputs go up. The emphasis is on how the practice feels to them; how they perceive the practice of natural farming. The response is not problematized with Trouble. Likewise in Fig. 9, Consciousness and Independence are linked in the farmer’s story, which is about a woman who has consumed chemical-free naturally farmed food from childhood onwards and is still healthy and independent at age 80. Consciousness is often associated with what the farmer’s consider “clean living”. The description reads that the woman “does not depend on any others for her work.” The image was named ‘Energy’ by the participant and demonstrates the widespread belief among farmers that consuming food grown through natural farming will grant a longer and healthier life, and the ability to remain independent at an old age.

Consciousness was often interwoven with Legacy and Memory, the two other prevalent narrative types in Visakhapatnam. Fig. 10 is a representation of the generative theme ‘Good Habits’. This theme emerged from an analysis of a photo collage depicting the SHG’s representation of ‘Health’. Participants took photos in their community that

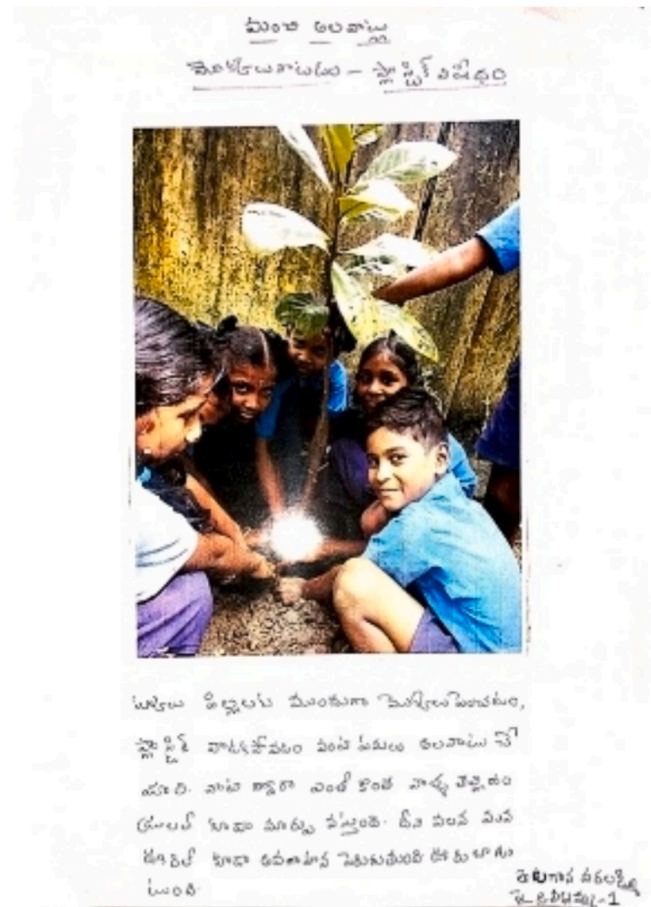


Fig. 10. A participant response from Visakhapatnam entitled *Planting trees/avoiding plastics*.

represented good habits, and the image in Fig. 10 depicts a group of children planting a tree. The description reads: “We must teach school children about planting trees and avoiding plastics so that we can also see a small transformation in their parents so that the awareness in our village will also be raised and the village will stay good.” There is a recurring message that rejects chemicals, plastics, and other foreign elements in the village. The village will stay healthy without them. This same thinking rejects chemical farming as unclean, and again any loss in yield or income resulting from the rejection of chemicals is outweighed by the benefit derived from ‘good habits’, especially when those good habits form part of the legacy of farming being left to the children.

Across the responses in Visakhapatnam, participants told stories about their childhoods, how their villages and traditions were when they were younger, and the importance of passing these stories and traditions on to their children. The Memory and Legacy narrative types were best exemplified by the farmer responses to the generative theme ‘Secured life’. Asked to represent ‘Secured life’ in an image with a story, a participant took a photo of children playing games, which she named *Childhood Games* (see Fig. 11). Her description of the photo reads: “Nowadays the school and the college kids and the boarders are losing their childhood memories. At least during the festive time, they are all meeting in one place, and they play games and have fun, and they will be able to stay happy for at least a few days. We feel happy when we see the children like that. Affection and unity increase among them, and their relationships are strengthened.” It is noteworthy that this photo and description are of a theme which emerged from an analysis of ‘Integrated Farming’—another theme that is very much on-script—and the ease at which participants moved off-script to discuss what was really of value to them in their community. To the farmer, children are losing their childhood

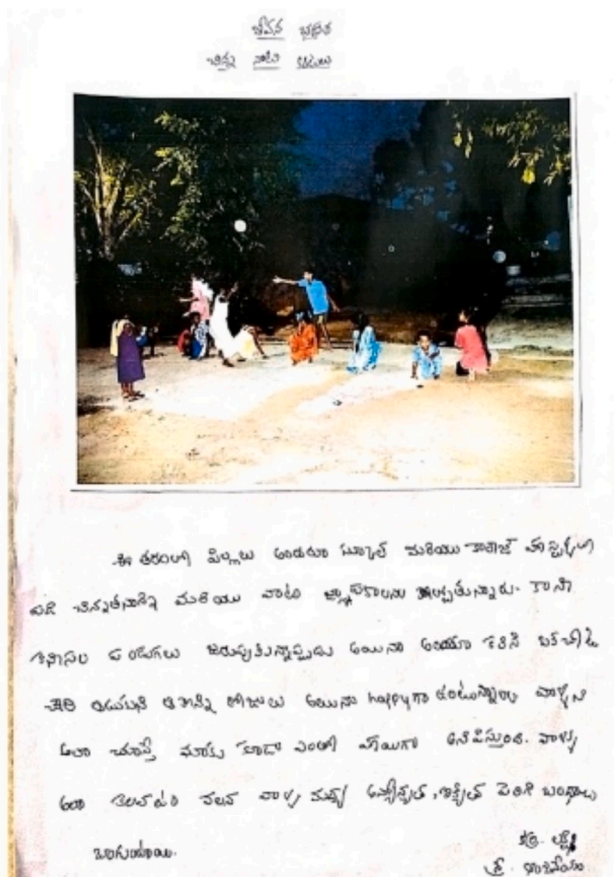


Fig. 11. A participant response from Visakhapatnam entitled *Childhood Games*.

memories, and natural farming was a means to reproduce an agricultural and communal landscape that mirrored their own childhoods. It was this physical and temporal space and the memories it engendered in them that they hoped would be the legacy left for their children.

In the final image we present from Visakhapatnam, also a representation of ‘Secured life’, memory becomes legacy. In Fig. 12, entitled *Marriage Gifts*, the farmer writes the following description: “I have hidden the bronze vessels given to me by my mother for my daughter’s marriage. In this generation these vessels are rare because the bronze is very pure. By giving these to my daughter the next generation will learn some of our traditions. Also, she will remember her mother and her grandmother. It will make me feel happy.” Life is secured by the ability to pass traditions from one generation to the next, and the thought of doing so brings happiness to the participant.

7. Mapping the narrative types onto yields

While the scope of this paper does not allow us to present an exhaustive review of every participatory photography response from the two districts, we have presented examples of all the different narrative types that emerged from the analysis. What is clear from the above participatory photography responses from Anantapur and Visakhapatnam is that stories farmers told with their photo responses were reflections of their lived experiences in the two districts. As shown in Fig. 13 below, Visakhapatnam farmers do not observe a significant yield increase because of ZBNF adoption. While they still fare better economically due to a decrease in the cost of inputs, farmers in their photo responses did not discuss yield or savings. Instead, the importance of independence was paramount, even if it came with the greater labor demands of natural farming. Subjective unquantifiable gains were frequently embedded in stories that were layered with the Memory,

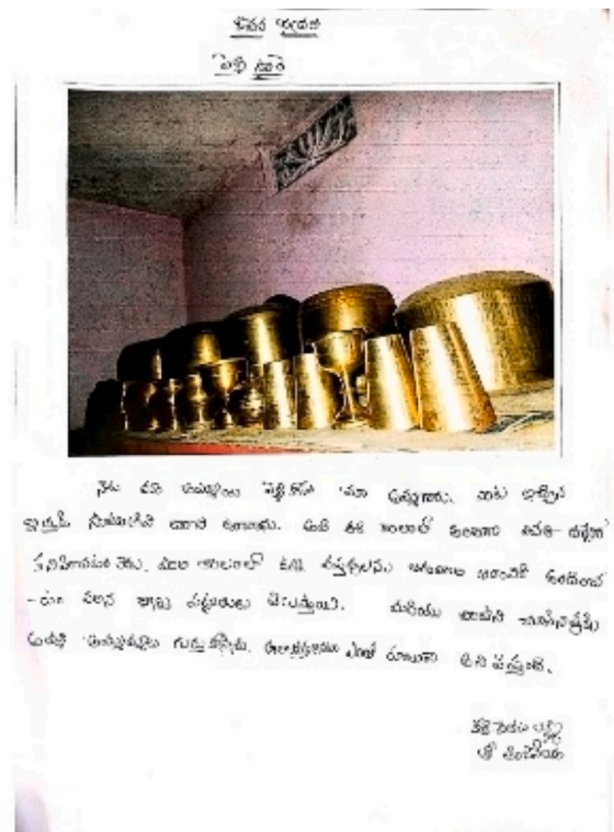


Fig. 12. A participant response from Visakhapatnam entitled *Marriage Gifts*.

Legacy, and Consciousness narrative types. Freedom from precarity and Trouble did not feature in their stories. This has implications for the way natural farming can be communicated to farmers who already have a measure of security in their lives. If farmer focus is not only on yields and income, but on adopting a practice that is more aligned with their subjective values, that opens new pathways for communicating the benefits of natural farming that do not involve simple assumptions about the centrality of income.

To farmers living in precarious situations, like those in a low rainfall zone such as Anantapur, the messaging, obviously, can be different. There, ZBNF yields, when compared to organic and conventional, supported public messaging—they were higher. Farmer stories in that district focused on rains, security, and the importance of money. The Independence narrative dominated, but, unlike Visakhapatnam, independence was not something the farmers had, reinforced by an identity as a natural farmer. In Anantapur, it was something farmers wished for, as told through stories riddled with Trouble. Independence meant independence from precarity. Therefore, on-script messaging may have more success in a district like Anantapur and not much adjustment is needed to what is currently being disseminated by RySS through their networks.

8. Conclusion

Our research approach brought together soil scientists who sought to understand the benefits natural farming provided to the soil and to ultimately evaluate the yield and income gains being reported by farmers, with social scientists whose interest it was to understand the complexity of adoption decision-making in context. As a team with many years of experience conducting research alongside rural and agricultural communities, we knew there would be more to the story than simply increases in yield and incomes, and we showed that farmers who adopted natural farming perceive their practices differently depending on their

Visakhapatnam narrative types:

- Legacy
- Memory
- Consciousness
- Independence (possessed)

Inclusive of stories about happiness, tradition, love of nature, clean living, good habits, being one with nature, children, the preservation of culture, shaping the future

Anantapur narrative types:

- Independence (desired)
- Consciousness
- Trouble

Inclusive of stories about water scarcity, water conservation, rains, self-reliance, the importance of money, freedom from precarity, entrepreneurship, empowerment, security

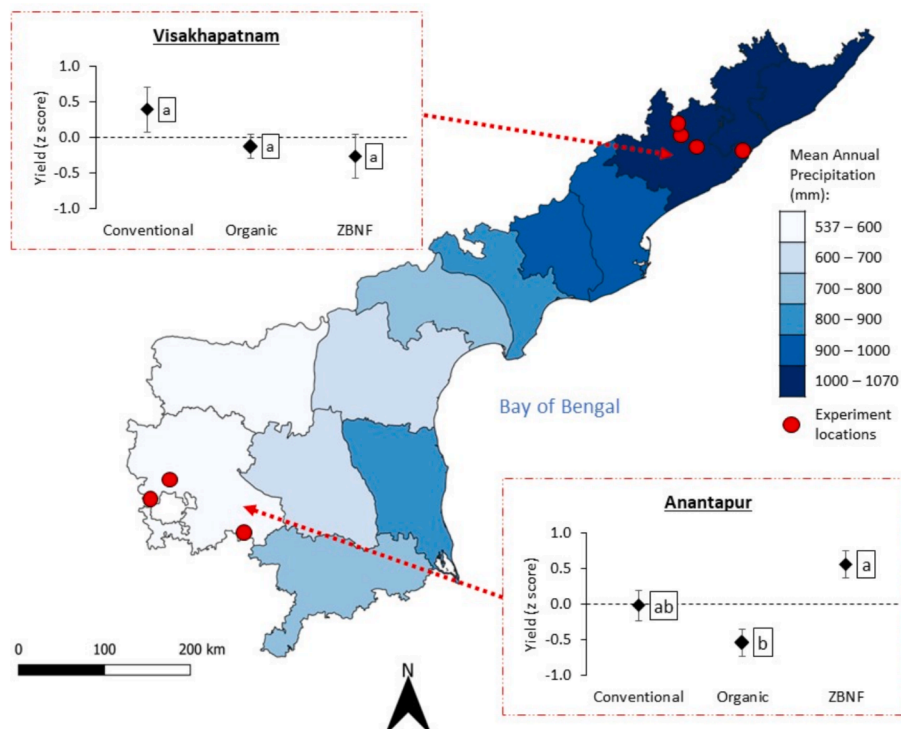


Fig. 13. Narrative types alongside yield measurements in Visakhapatnam and Anantapur. The mean of each treatment (conventional, organic, ZBNF) is shown across all experiments in that district over both seasons. Error bars are standard error of the mean. Treatments labelled with the same lower-case letter (a, b) in a particular district are not significantly different according to the REML mixed-effect model.

context. According to Frank (2010), research too often silences participants by enumerating “all that is significant about them” (p. 98). From a dialogical perspective, this is not only ethically questionable but false, because it “creates a pretension of knowing what cannot be known” (p. 98). We took an interdisciplinary approach, using qualitative and quantitative methods and data, to tell a story of decision-making, adoption, and innovation, and the way these decisions are embedded within the lived experiences of individuals, families, and communities. The stories told by participants reflect important values they hold, which influence their understanding of ZBNF and what drives their adoption of its practice. A reductive approach toward ZBNF promotion does not consider the layers of behavior and identity that are specific to context. As the practice expands throughout Andhra Pradesh, and indeed across India, messaging will be more effective if it considers the multi-layered reality of farmer decision-making, and the broad diversity of perceptions farmers have of the practice. Further, the stories told by farmers as they experience an agricultural transition can impact future research, which can be tuned to local need. In Visakhapatnam, for example, future researchers might seek further understanding of the nutritional benefits of ZBNF, while in Anantapur they might focus on the climate resilience of cropping systems. If the overarching objective is the expansion of natural farming, then it must be just and avoid the mistakes of approaches that, while claiming to do something different, simply repeat top-down hierarchies of control and knowledge transfer.

As PAR has shown over the decades, the promotion of subjective perceptions and an emphasis on participation are essential elements in social justice frameworks (Lenette, 2022). The substantial role that just agricultural transitions must play in addressing socio-environmental challenges today requires that agricultural decision makers make genuine efforts to understand farmer stories and use that understanding

to promote agricultural practices that simply do less harm to the environment, the soil, and the farmers who till it.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Table 3 shows the thematic progression of topical and generative themes in this study. These are the themes that were determined by the participants through their group discussions. Recalling Frank's framing of dialogical narrative analysis as a method that "studies the mirroring between what is told in the story—the story's content—and what happens as a result of telling that story—its effects" (2010p. 72), each theme can be conceived of as the outcome, or effect, of the sharing and discussion of the photo stories in the previous thematic discussion.

The early themes in the progression represent 'on-script' messaging, as would be expected. This is certainly true of the topical themes, which were proposed to the SHGs by the NFFs. Even the first set of generative themes remained 'on-script' to an extent, with themes such as ZBNF four wheels, Extra income, and Soil renovation, all drawn from the public transcript of ZBNF. The subsequent generative themes then moved further 'off-script' and began to represent farmer perceptions of issues that are of importance to them.

Table 3
Thematic progression.

Thematic Progression			
District	Anantapur		Vishakhapatnam
SHG name	Anjali Mahila Sangam	Sri Sai Mahila Sangam	Sri Anjaneyam
Topical theme	Pest management	Water conservation	Cow-based farming & mulching
Generative theme 1	Health is wealth & Peace of mind	Sanitation and health	Extra income & ZBNF four wheels
Generative theme 2	Knowledge and skill	Women's empowerment	Integrated farming
Generative theme 3	Joyfulness	Importance of money	Secured life
Generative theme 4	n/a	n/a	Happiness with satisfaction
			Pydithallamma – 1
			Farming with natural resources
			ZBNF awareness and soil renovation
			Health
			Good habit
			Responsibility

Data availability

Data will be made available on request.

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